Agriculture

Methane is produced and emitted from the decomposition of livestock manure and the organic components in agro-industrial wastewater.[9] These wastes are typically stored or treated in waste management systems that promote anaerobic conditions (e.g., liquid or slurry in lagoons, ponds, tanks, or pits) and produce biogas, a mixture of about 70 percent methane, 30 percent CO_2, and less than 1 percent hydrogen sulfide.

GMI helps brings together the collective resources and expertise of the international community to address technical and policy issues and to facilitate anaerobic digestion (AD) projects in Partner Countries. GMI also provides a forum to reduce AD project development barriers that commonly exist by raising awareness about AD technologies, building capacity, developing strategies and markets, assisting with project financing, and working directly with Partners to address specific technical and financial concerns.

Through GMI, the United States advances the recovery and use of methane at agricultural operations in several countries, including China, the Philippines, and Thailand. U.S.-supported workshops and demonstration projects are instrumental in ensuring successful development of commercially operating AD projects. Many of these activities, which provide multiple benefits, such as water pollution control and improved rural sanitation, will continue to yield methane emission reductions in future years.

Working With Small- to Medium-Scale AD Systems in the Philippines

In the Philippines, the agriculture sector contributes 71 percent of the country's methane emissions, of which livestock manure accounts for approximately 10 percent.[10] Because many of the emissions are from small farms, EPA has focused on supporting small-scale AD technology development, including fixed domes, stacked domes, and tubular and bag digesters.

In 2011, the Philippine Council for Industry and Energy Research and Development hosted a series of training workshops supported by a joint initiative between EPA and the World Bank. These trainings were intended to develop a cadre of in-country technical experts who learn to design AD systems, manage system construction, and train AD operators in the operation, maintenance, and troubleshooting of these systems. The workshops covered a range of topics, including digester design (i.e., estimates of standing pig population,

Tubular digester in the Philippines

[9] Agricultural methane sources also include rice cultivation and enteric fermentation. GMI's Agriculture Subcommittee focuses on livestock and agro-industrial wastes.

[10] U.S. EPA, 2012.

process water use, potential energy reduction calculations); digester financing and performance (e.g., quantification of certified emission reductions); hands-on digester design, construction, and operation; flare installation; gas handling; and methane measurement, verification, and reporting.

As part of these trainings, EPA developed pilot-scale tubular digesters with larger diameter material (appropriate for up to medium-scale farms) that reduce costs by 50 percent when compared to other designs.

In 2011, EPA developed a simple Excel-based calculator tool to assist in designing covered lagoon systems for swine waste management in the Philippines. Using the tool is straightforward; it has a simple interface through which users enter farm-specific data. The tool estimates design parameters, emission reductions, energy generation potential, and costs for swine-related covered lagoon systems. Similar tools for other countries may be developed in the future for use in digester design-related trainings. EPA also supported the development of technical standards for small-scale AD systems to enable Philippine farmers to design and operate these systems.

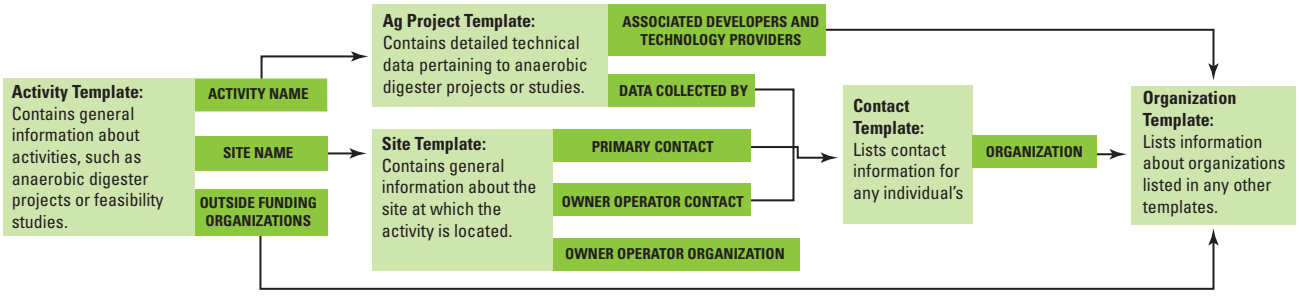
Developing the International AD Database

The United States contributed to the development of an international AD database that provides information on the types and scale of operating AD systems in GMI Partner Countries. This information can help identify the types of projects that are successful in certain countries or regions. In 2011, EPA began collecting data from Partner Countries using a standardized data collection template (see Figure 7). Currently, the database contains information on more than 450 AD systems in China, Mexico, the Philippines, Thailand, and Vietnam (Table 2). These projects involve more than 3.5 million swine and almost 100,000 dairy cows. EPA expects the number of commercially operating AD projects to increase as it continues to develop programmatic environments by which projects can be deployed using local design and service industries around the world.

Table 2. Commercially Operating AD Projects in the International AD Database

Country	Number of Projects
China	15
Mexico	395
Philippines	6
Thailand	33
Vietnam	14

Figure 7. International AD Database Data Collection Template



Conducting Resource Assessments

EPA continues to support a strategic approach to reducing methane from the agriculture sector by assisting with the development of country-specific resource assessments (RAs). These assessments are critical planning tools that identify and rank the agriculture sectors and subsectors for potential emission reductions. In 2011, EPA finalized RAs for the Dominican Republic and Turkey. Based on the RAs EPA has conducted to date, more than 55 $MMTCO_2E$ could be reduced by implementing AD systems for agricultural waste in those Partner Countries (see Table 3).

Table 3. Potential Emission Reductions Identified in Resource Assessments

Country	Potential Emission Reductions ($MTCO_2E/y$)
Argentina	2,274,700
Brazil	20,313,300
Colombia	1,241,700
Dominican Republic	354,800
Ecuador	386,500
India	5,716,100
Mexico	14,785,600
Philippines	2,553,800
Thailand	4,956,000
Turkey	1,328,100
Vietnam	1,420,300
Total	**55,330,900**

Leveraging Funds and Partnerships

Since 2006, the United States has entered into partnerships with GMI Partner Countries, NGOs, farm owner cooperatives, the United Nations (U.N.), and the World Bank. Through funds and technical assistance agreements, these partnerships have successfully increased adoption of AD technology.

The Livestock Waste Management East Asia project, for example, was a partnership between GMI, the World Bank, the U.N. Food and Agriculture Organization (FAO), commercial farmers, and the governments of participating countries (China, Thailand, and Vietnam). The program promoted institutional capacity-building and policy development and implementation to create affordable pollution control methods for livestock waste management in order to reduce major negative environmental and health effects associated with concentrated livestock production. The project began in 2006 and was completed in December 2011. Over the course of the project, the World Bank provided $21 million in funding, with partner governments and farm owners contributing additional funds. EPA and FAO provided technical assistance and additional funding to help implement projects and increase the number of participating farms.